REPORTS ON FISHES OF THE UNIVERSITY OF SOUTHERN CALIFORNIA ANTARCTIC RESEARCH PROGRAM, 1962-1968

1. A REVIEW OF THE GENUS *BATHYDRACO* GÜNTHER (FAMILY BATHYDRACONIDAE)

by

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ABSTRACT. – A diagnosis and description of *Bathydraco* are presented, the most salient characteristics being scales, a single lateral line, and opercles not armed with spinous points or a hook. The genus is compared with other bathydraconid genera and a key to the species is given. Diagnosis and descriptive notes, based on the *Eltanin* material as well as type specimens, are presented for the four previously known species (*B. scotiae, B. antarcticus, B. macrolepis,* and *B. marri*) and *B. joannae, sp. nov.*, is described and figured. The distribution and relationships of the species are discussed. The deepwater *B. scotiae* stands apart from the others, which form two pairs, each with a deeper and a shallower (though overlapping) member : *B. antarcticus* and *B. macrolepis*; *B. joannae* and *B. marri*.

RÉSUMÉ. – L'auteur donne une diagnose et une description du genre *Bathydraco* dont les principaux caractères portent sur la disposition des écailles, la présence d'une seule ligne latérale et l'absence d'épines ou de crochets sur les opercules. Le genre est comparé aux autres genres de Bathydraconidae et une clé des espèces est donnée. Les diagnoses et descriptions fondées sur le matériel récolté par l'*Eltanin* et sur les spécimens-types, sont présentées pour les quatre espèces déjà connues (*B. scotiae, B. antarcticus, B. macrolepis* et *B. marri*) et une nouvelle espèce *B. joannae* sp. n. est décrite et figurée. La répartition et les relations des cinq espèces sont discutées. L'espèce de profondeur *B. scotiae* forme un groupe à part, les autres forment deux paires, chacun avec une espèce d'eau profonde et une espèce d'eau peu profonde : *B. antarcticus* et *B. macrolepis, B. joannae* et *B. marri*.

Key-words : Pisces Bathydraconidae, Bathydraco scotiae, Bathydraco antarcticus, Bathydraco macrolepis, Bathydraco marri, Bathydraco joannae, new species, taxonomy, PS Antarctic Ocean.

INTRODUCTION

This is the first in what the author intends to be a series of papers reporting upon the fishes collected by personnel of the University of Southern California

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from the USNS *Eltanin* during the years 1962-1968. The areas visited by the *Eltanin* extend from the South Sandwich Islands west to the Ross Sea and include such isolated islands as Scott and Macquarie. The « USC - *Eltanin* » collections are very rich in relatively deep-water bottom species, especially from the Scotia and Ross Sea regions. Collection data from cruises 1 through 27 have been published (Savage and Caldwell, 1965, 1966, 1967). Data for cruise 32 may be obtained from the Smithsonian Oceanographic Sorting Center, Washington, D.C.

The papers are intended to serve two basic purposes : 1) to make known the extent of the collections, to provide locality records, and to indicate where the material is housed ; 2) where appropriate to provide diagnoses, reviews or revisions of groups and species together with keys for identification. Each number may, therefore, differ in type of content.

Fishes of the genus *Bathydraco* have until recently been among the rarest known, less than ten specimens having been captured up to the beginning of the 1960's. The *Eltanin* collections are, therefore, very rich in this group, comprising 183 specimens of five species, one of which is undescribed. The present review redefines the genus in light of the transfer of *Bathydraco nudiceps* Waite to *Akarotaxis* by DeWitt and Hureau (1979), diagnoses each species, and presents a key for their identification. In addition to the *Eltanin* material, I have been able to examine the types of all species as well as a few other specimens in various museums and collections.

Museum abbreviations are used as follows : BMNH (British Museum (Natural History), London), LACM (Natural History Museum of Los Angeles County), MNHN (Muséum national d'Histoire naturelle, Paris), RSM (Royal Scottish Museum, Edinburgh), UMO (University of Maine, Orono), USNM (United States National Museum of Natural History, Washington, D.C.), ZIN (Zoological Institute, Academy of Sciences, Leningrad).

« N.Z. Endeavor » refers to the New Zealand research vessel « Endeavor » which worked in the Ross Sea during the late 1950's and early 1960's. The collection data were published by Bullivant (1967) and, for fishes, Reseck (1961).

Measurements and counts were made as described by DeWitt (1970). In the text measurements are expressed as thousandths of the standard length (SL) or the head length (HL). The nomenclature of the lateral line system follows DeWitt (1962, p. 831).

Bathydraco Günther, 1878

Bathydraco Günther, 1878 : 18 ; Günther, 1887 : 47 ; Dollo, 1906 : 66 ; Regan, 1913 : 281 ; Norman, 1938 : 54.

Diagnosis.

Bathydraconid fishes with scales ; with a single lateral line on side of body ; snout flattened and spatulate ; interorbital space very narrow between large orbits ;

jaws without canine teeth; vomer and palatines toothless; nostrils postero-medial to anteriormost pore of infraorbital canal; branchiostegal rays 6-8, usually 7; opercles not armed with spinous points or a hook.

Description.

Body very elongate and slender (depth 6-10 of SL); snout long, flattened and spatulate (280 - 350 of HL); gape long, maxillaries extending posteriorly to or just below anterior part of eyes (upper jaw length 310 - 390 of HL), lower jaw projecting; orbits large (210 - 300 of HL); interorbit narrow (50 - 100 of HL); all teeth in jaws small, conical and pointed, in single bands in each jaw; vomer and palatines toothless; upper pharyngeal teeth in three patches on each side; fifth ceratobranchials toothed; both ctenoid and non-ctenoid scales may be present; a single lateral line on side of body extending from supracleithrum to or toward midbase of caudal fin; cephalic lateral line canals enlarged, complete and of normal pattern (temporal, supraorbital and infraorbital canals interconnected behind eye; supraorbital canals connected to each other through large coronal space which opens to exterior through a coronal pore; supratemporal canal complete across top of head; preoperculomandibular canals not connected to temporal canals or to each other across symphysis of lower jaw; canal formulae : preoperculomandibular 9, infraorbital 7, supraorbital 4 (rarely 3), temporal 5-6 (6 probably correct, the posteriormost pore often not discernible because of torn skin), supratemporal 3; larger gill rakers of anterior series of first arch elongate, bearing teeth along upper-medial edge; other gill rakers shorter, blunt, bearing teeth distally or occasionally also on upper-medial edge; pseudobranchiae present; branchiostegal rays 6-8, usually 7; opercles unarmed, without a spinous process or hook; gill membranes joined to each other and to isthmus only anteriorly, forming a narrow fold across isthmus; nostrils tubular, single on each side, placed postero-medial to anteriormost pore of infraorbital canal, closer to eyes than tip of snout; fins with soft rays only (uppermost pectoral ray unsegmented, but of two halves); a single dorsal fin; principal caudal rays 12-14; vertebrae 16-19 + 32-38 = 48-56.

Discussion.

DeWitt and Hureau (1979) distinguished the genera *Bathydraco, Akarotaxis, Vomeridens* and *Racovitzia*, and presented a key to the genera of the family Bathydraconidae. The two other scaled genera in the family, *Prionodraco* and *Gerlachea*, are easily distinguished from *Bathydraco*. The first has two rows of chevron-shaped scutes on each side of the body, each scute armed with a spine; each opercular has a flattened and posteriorly rounded blade with a serrated posterior border and a dorsal anteriorly curved hook; the anterior gill rakers of the first arch are elongate, but not toothed; and there are 6, rarely 7, branchiostegal rays. *Gerlachea* has small, entirely non-ctenoid scales; two lateral line canals on the body, an upper near the dorsal fin and a lower near the anal fin which, however, is irregularly developed; the nostrils placed closer to the tip of the snout than the eyes and anterior to the anteriormost pore of the infraorbital canal; the supratemporal canal incomplete across the top of the head; and all gill rakers low, dentigerous nubbins.

Bathydraco comprises fishes from rather deep water, the range being approximately 500-2600 m (DeWitt, 1971), and includes the deepest living members of the notothenioids. The family Bovichtidae (*Bovichtus, Cottoperca* and *Pseudaphritis*) and the genus *Eleginops* of the family Nototheniidae are the only other notothenioids with a single lateral line on the side of the body.

Key to the species of *Bathydraco*

1a. 20-24 gill rakers in anterior series on lower limb of first arch; total anterior gill rakers 27-33; 37-45 tubular scales in lateral line, which ends below 5-12 from last rays of dorsal fin . . . . *B. scotiae.*

1b. 11-19 anterior gill rakers on lower limb of first arch; total anterior gill rakers 15-26; 51-70 tubular scales in lateral line, which ends posterior to base of dorsal fin . . . . 2.

2a. Head length 330 of SL or greater; distance between anal origin and caudal base less than 500 of SL; distance from snout to anal origin 520 of SL or greater. 3.

2b. Head length 320 of SL or less; distance between anal origin and caudal base 500 of SL or greater; distance from snout to anal origin 510 of SL or less . . 4.

3a. 36-38 dorsal rays; 11 scale rows between dorsal origin and lateral line; lateral scales 103-116 . . . . *B. antarcticus.*

3b. 32-35 dorsal rays; 5-8 scale rows between dorsal origin and lateral line; lateral scales 83-95 . . . . *B. macrolepis.*

4a. 14-17 gill rakers in anterior series on lower limb of first gill arch; 26-32 gill rakers in anterior and posterior series of lower limb of first arch; 55-67 tubular scales in lateral line; scales present only on upper 5 to 7 tenths of opercles; color a rather uniform brown, the fin somewhat darker . . *B. joannae,* n.sp.

4b. 11-15 gill rakers in anterior series on lower limb of first arch; 20-28 gill rakers in anterior and posterior series of lower limb of first arch; 51-61 tubular scales in lateral line; upper 8 to 9 tenths of opercles (rarely less) scaled; ground color pale, with a series of blotches and bars of various sizes on sides and across back (coloration darker on larger specimens) . . . . *B. marri.*

Bathydraco scotiae Dollo, 1906

Bathydraco scotiae, Dollo, 1906 (original diagnosis; type locality 71°22'S, 16°34'W); Regan, 1913 (description, fig.); Norman, 1937 (recorded from 64°21'S, 116°02'E); Norman, 1938 (description); DeWitt, 1971 (distribution).

Material examined.

BMNH 1912.7.1.52 (1 : 113 mm; Syntype); RSM 1921. 143.475 (1 : 122 mm; Syntype); Elt. St. 529 (1 : poor cond.; LACM); Elt. St. 610 (1 : 162 mm; USNM 227938); Elt. St. 1867 (1 : 132 mm; LACM 10561); Elt. St. 1937 (2 : poor cond., ca. 109 & 168 mm; LACM); Elt. St. 2113 (2 : 146 & 167 mm; LACM).

Diagnosis.

Orbit small (207-221 of HL); snout long (325-350 of HL); distances between tip of snout and origins of dorsal and anal fins short (369-393 and 489-505 of SL, respectively); distance between anal origin and midbase of caudal fin moderately long (501-515 of SL); distance between lateral base of pelvic fins and anal origin moderately short (223-228 of SL); only upper 250-300 of opercles scaled; 20-24 gill rakers in anterior series on lower limb of first gill arch; total anterior gill rakers 27-33; 38-40 rays in dorsal fin; lateral line with 37-45 tubular scales, the canal ending below the 5th to 12th from last rays of dorsal fin; vertebrae 17-19 + 36-38 = 53-56.

Descriptive notes.

The relatively small eyes do not bulge greatly into the dorsal profile of the head. The lateral line differs from that of other members of the genus in that it does not curve ventralward to lie on the midside of the body, but remains one scale row above the midside. The cephalic lateral line canals, especially on the snout and lower jaw are enlarged to a greater extent than in the other species.

Scales ctenoid except anteriorly on ventral surface between and anterior to bases of pelvic fins. Scales extend onto base of caudal fin, but not pectoral fins, and are present on head only in a patch on anterior part of upper 250 to 300 of opercles (above opercular ridge) and on cheeks behind eyes except for about ventral one-tenth.

Body mostly pale brown, somewhat darker in lower half, especially on belly and above anterior part of anal fin. Opercles, opercular membranes, lateral and anterior parts of snout, nostrils, and cheeks darker. Four indistinct, slightly darker bars present across back of specimen from station 1867; only faint indications of similar bars present on other specimens. Pectoral, pelvic and caudal fins dark brown; rays of anal fin dusky except at tips, especially anteriorly; dorsal fin mostly pale with a dusky area anteriorly.

Bathydraco antarcticus Günther, 1878

Bathydraco antarcticus Günther, 1878 (original description; type locality 60°52'S, 80°20'E; 2369 m); Günther, 1887 (description, figure); Regan, 1913 (description); Norman, 1938 (description); Andriyashev, 1958 (listed); Andriyashev and Tokarev, 1958 (listed from Kerguelen; 1600 m); Andriyashev, 1959 (vertebral and free interneural counts); Andriyashev, 1964 (listed); Andriyashev, 1965 (listed); DeWitt, 1971 (distribution); Hureau, 1979 (listed from Kerguelen and Heard Islands).

Material examined.

BMNH 1887.12.7.13 (1: 226 mm; Holotype); ZIN 37860 (1: 184 mm); Elt. St. 1555 (2: 220 & 226 mm, USNM 227944); Elt. St. 1560 (3: 188-238 mm; LACM 11048).

Diagnosis.

Head large (333-347 of SL); orbits relatively small (222-240 of HL); snout and upper jaws relatively large (318-348 and 344-388 of HL, respectively); distances between snout and origins of dorsal and anal fins large (414-438 and 515-536 of SL, respectively); distance between anal origin and base of caudal fin short (460-483 of SL); distance between anal origin and base of pelvic spine large (722-767 of HL); scales present on only upper one-half of opercles; anterior and posterior gill rakers on lower limb of first arch 15-19 and 13-14, respectively; total gill rakers of first arch (anterior and posterior series) 37-44; dorsal and anal fins with 36-38 and 31-33 rays, respectively; 60-70 tubular scales in lateral line; 11 scale rows between lateral line and base of first dorsal ray; vertebrae 17-18 + 34-36 = 52-53.

Descriptive notes.

The eyes bulge prominently into dorsal profile of head. Virtually all scales are ctenoid; only the very small scales on the caudal fin, in the flesh on the lateral base of the pectoral fin and the anteriormost scales on the isthmus are non-ctenoid. Where specimens have been roughly treated (as in a trawl) scales may be missing or abraded and the impression of being non-ctenoid. Most of the head is naked, but the cheeks are scaled (except over the infraorbital and preopercular canals) as far anteriorly as posterior ends of preorbitals and scales are present on the upper one-half of the opercles, extending to just below and along the thickened, posteriorly directed, opercular process.

The color (in alcohol) is a nearly uniform light brown without any prominent markings. The brown peritoneum shows through the skin giving the belly a somewhat darker appearance. The naked parts of the head, except the opercles, are lighter. The lining of the branchial cavity is brown and shows through the branchiostegal membranes and opercular bones. The nostrils are darker. The membranes between the anterior rays of the dorsal fin are darker brown, but the rest of the fin is light. The distal three-fourths of the anal rays and membranes are brownish, the basal one-fourth light. The caudal and pelvic fins are darker. Parts of the uppermost ray and the lower rays of the pectoral fins are brownish.

A radiograph of a 188 mm SL specimen from USC-Elt. Station 1560 shows that abdominal vertebrae 13, 14, and 15 are crushed together. The three are distinct, but are shattered and shortened, especially number 14. The specimen was early recognized as confusing since measurements of the snout to anal, anal origin to caudal, and anal to pelvic distances would not allow unambiguous identification. It seems likely that the three short vertebrae have caused both a shortening of the abdominal region and, thereby, the confusingly short measurements (see tables 7, 8 and 9).

Bathydraco macrolepis Boulenger, 1907

Bathydraco macrolepis Boulenger, 1907 (original description and figure; type locality southwest of the Balleny Islands, 461 m); Regan, 1913 (description); Norman, 1938 (description); Reseck, 1961 (listed); DeWitt, 1971 (distribution).

Material examined.

BMNH 1906.5.8.70 (1 : 179 mm, Holotype) ; ZIN 37859 (1 : 233 mm) ; Elt. St. 1999 (1 : 170 mm ; MNHN 1982-128) ; Elt. St. 2012 (1 : 104 mm ; LACM) ; Elt. St. 2016 (1 : 167 mm ; BMNH 1982.4.14.6) ; Elt. St. 2050 (2 : 164 & 194 mm ; LACM) ; Elt. St. 2059 (3 : 131-171 mm ; USNM 227940) ; Elt. St. 2065 (1 : 167 mm ; ZIN) ; Elt. St. 2108 (2 : 229 & 242 mm ; LACM).

Diagnosis.

Head large (336-368 of SL) ; distances between tip of snout and origins of dorsal and anal fins large (422-454 and 516-558 of SL, respectively) ; distance between anal origin and midbase of caudal fin small (449-484 of SL) ; only about upper three-tenths of opercles scaled ; gill rakers of first arch relatively few in most combinations (anterior series of lower limb 12-15 ; posterior series of lower limb 11-12 ; both series on lower limb 23-27 ; total number in posterior series 12-16 ; total in both series 31-36) ; rays in dorsal and anal fins 32-35 and 28-30, respectively ; 5-8 scale rows between lateral line and base of first ray of dorsal fin ; 51-59 tubular scales in lateral line ; vertebrae 16-17 + 32-34 = 48-51.

Descriptive notes.

All scales are ctenoid except for a few very small ones which may be present in the flesh of the lower half of the bases of the pectoral fins. The upper eight to nine tenths of the cheeks behind the eyes (not including the lateral line canals) are scaled ; scales are absent below the eyes ; the head is naked except for the cheek and opercular scales.

The color (in alcohol) is a rather uniform light brown with the lower parts of the body somewhat darker. On the holotype there are faint suggestions of five darker bars across the back, the first at the origin of the dorsal fin, the second above the tip of the appressed pectoral fin and the fifth at the posterior end of the dorsal fin, the two others evenly spaced between the second and fifth. There are faint indications of midlateral blotches between the third, fourth and fifth bars as well as blotches below the lateral line between the first, second and third bars. In none of the larger specimens from the *Eltanin* collections are such markings present, but the 104 mm specimen from station 2012 has three or four darker marks below the midline of the body, the first covered by and below the beginning of the distal one-third of the appressed pectoral fin, the second behind the tip of the fin, the third above the beginning of the posterior half of the anal fin base and the fourth (very indistinct) near the end of the anal fin. In the larger specimens the lower half of the body is distinctly darker, but without the markings. The caudal and anal rays are darker, the pectoral and pelvic fins a little paler (in the small specimen all fins except the caudal are pale). In the larger specimens the opercles below the scaled area seem translucent and therefore appear darker. The bone and skin on the top of the head behind the eyes is almost transparent, allowing the brain to be visible as a pale organ in a darker region. The nostrils of the holotype are pale, but they are dark and distinct on all the *Eltanin* material.

Bathydraco marri Norman, 1938

Bathydraco marri Norman, 1938 (original description and figure ; type locality 76°09.6'S, 168°40'E, 520 m) ; DeWitt, 1971 (distribution and occurrence) ; Jakubowski, 1975 (absence of internal nares).
Bathydraco **sp.** Reseck, 1961 (listed).

Material examined.

BMNH 1937.7.12.671 (1: 95.5 mm ; Holotype) ; UMO 90 (2: 174 & 175 mm) ; « N.Z. Endeavor » St. A459 (1: 80.3 mm) ; Elt. St. 426 (3: 198-223 mm ; USNM 227941) ; Elt. St. 432 (1: 174 mm ; LACM 10485) ; Elt. St. 538 (5: 168-210 mm ; LACM 10532) ; 1078 (2: 165 & 204 mm ; LACM 10433) ; Elt. St. 1079 (1: 205 mm ; LACM 10441) ; Elt. St. 1873 (4: 73.0-110 mm ; UMO 385) ; Elt. St. 1878 (1: 96.9 mm ; poor condition ; LACM) ; Elt. St. 1889 (1 ; poor condition ; LACM) ; Elt. St. 1916 (2: 89.8 & 104 mm ; poor condition ; LACM) ; Elt. St. 1930 (3: 182-198 mm ; LACM) ; Elt. St. 1931 (1: 107 mm ; poor condition ; LACM) ; Elt. St. 1933 (6: 70.8-151 mm ; MNHN 1982-130) ; Elt. St. 1936 (1: 75.5 mm ; LACM) ; 2005 (3: 191-205 mm ; ZIN 46188) ; Elt. St. 2006 (1: 197 mm ; LACM) ; Elt. St. 2016 (11: 115-148 mm ; USNM 227943) ; Elt. St. 2021 (1: 149 mm ; LACM) ; Elt. St. 2034 (1: 153 mm ; LACM) ; Elt. St. 2036 (1: 123 mm ; LACM) ; Elt. St. 2039 (2: 133 & 162 mm ; USNM 227939) ; Elt. St. 2045 (1: 120 mm ; BMNH 1982.4.14.3) ; Elt. St. 2050 (2: 147 & 155 mm ; BMNH 1982.4.14.1-2) ; Elt. St. 2068 (1: 101 mm ; LACM) ; Elt. St. 2085 (3: 114-117 mm ; USNM 227942) ; Elt. St. 2095 (5: 115-150 mm ; LACM) ; Elt. St. 2097 (24: 99.6-126 mm ; LACM) ; Elt. St. 2106 (1: 112 mm ; LACM) ; Elt. St. 2116 (2: 185 & 208 mm ; LACM) ; Elt. St. 2117 (5: 160-189 mm ; UMO 386) ; Elt. St. 2119 (1: 188 mm ; USNM 227945).

Diagnosis.

Head small (280-322 of SL) ; orbits relatively large [228-299 (in one specimen 337) of HL]; distances between snout and origins of dorsal and anal fins short (369-409 and 461-496 of SL, respectively); distance between anal origin and midbase of caudal fin large (505-546 of SL) ; upper seven to nine tenths of opercles scaled; gill rakers on first arch relatively few (anterior series on lower limb (9) 11-15; total anterior series 15-22; posterior series on lower limb 8-14; anterior and posterior series on lower limb 20-28; total in both series 27-37); 51-61 tubular scales in lateral line; body with a series of bars and blotches on a pale background, most prominent on smaller individuals, markings becoming less distinct as ground color darkens on larger specimens; vertebrae 16-18 + 33-36 = 51-54.

Descriptive notes.

Scales on body and head all ctenoid; scales extend onto base of caudal fin and onto lateral bases of pectoral fins ; cheeks scaled except over lateral line canals and below eyes.

Color (in alcohol) rather variable. The following description is from the holotype. A number of more or less irregular bars and blotches present on body; seven bars cross the back and extend variable distances ventrally : the first crosses in a narrow band under first rays of dorsal fin, then becomes broader on the sides, reaching lateral line ; the second crosses a short distance anterior to tip of appressed pectoral fin and extends to lateral line ; the third, very broad, crosses below about middle of dorsal fin and extends below lateral line, forming an almost complete ring about body; the fourth is smaller and extends only to lateral line; the fifth is the broadest, crosses back under posterior rays of dorsal fin and forms a complete ring around the body; the sixth crosses caudal peduncle and extends ventrally to lateral line ; the seventh lies just anterior to caudal fin on the expanded portion of caudal peduncle, passing over upper procurrent caudal rays, and extends slightly below lateral line. In addition to the bars are several dark blotches on the sides : two anterior to first bar, the anteriormost above and a little anterior to upper end of pectoral fin base ; one above lateral line between first and second bars; a larger one between second and third bars resting on lateral line; and one each between third and fourth and fourth and fifth bars on midside of body. There are also a few blotches below lateral line in area of body covered by pectoral fins. A dark spot may be present anterior to pectoral fin base (present on right, absent on left). No very distinct markings on head. A line behind eye extends across cheek onto upper opercle where it becomes broader ; a second line extends from postero-ventral edge of eye to angle of preopercular. Dorsal rays with dark areas near bases forming horizontal line, the anterior rays also with a more distal dark area. Anal fin pale. Caudal fin brownish. Upper pectoral rays with some brown pigment, especially basally. Pelvic fins light except for some brown on distal portions of spine and first three rays.

The color of the *Eltanin* material varies considerably from the above description. In somewhat larger specimens (100-150 mm SL) there may be very numerous blotches of various sizes on the sides of the body and on the head. In some the bars may be absent as such and represented by larger blotches, very occasionally on only the lower half of the body. In others the second, third and fifth bars may be very prominent and the others absent or represented by blotches. In larger specimens this color pattern becomes less distinct as the general body color becomes darker. The smallest specimen in the present material, 75.5 mm SL from station 1936, has the simplest and most vivid markings. Tip of snout and lower jaw, nostrils, a heart-shaped area on top of head (point at occiput), a small horizontal blotch on upper part of cheek, and a less distinct area on upper opercle all a warm brown. Two brown spots anterior to pectoral base, one at upper end and partly covered by opercular flap, the other in upper half of musculature anterior to pectoral rays ; basal portions of upper pectoral rays brown creating a vertical line. Four distinct bars cross back : first crosses about half way between occiput and dorsal fin origin and extends ventrally almost to lateral line ; second crosses below first four rays of dorsal fin and extends almost to lateral line ; third crosses below dorsal rays 15-18 and forms a complete ring around the body, much broader below lateral line ; fourth crosses below posterior part of dorsal fin and is similar to third. Two less distinct blotches on back, first between third and fourth bars and second behind dorsal fin on anterior part of caudal peduncle. Caudal fin uniformly dark brown. Peritoneum brown, visible as dark area in midventral region anterior to anus.

In comparing the description of the holotype with the present material, the first cross bar on the smallest specimen presumably becomes a pair of blotches associated with, or the same as, the upper anterior dark mark anterior to the pectoral fin base ; the median portion fades. The first bar of the holotype unites with the second bar, forming a broad bar under the first rays of the dorsal fin. In none of the *Eltanin* specimens is there a separate narrow bar below the anterior dorsal rays. In none of the larger specimens does any band clearly encircle the body, but many show a paler continuation of the two broadest bars about the ventral half of the body.

Bathydraco joannae n. sp. (Fig. 1)

Material examined.

Elt. St. 731 (1: 167 mm; *Holotype*; LACM 10606); BMNH 1939.6.20.23* (1: 146 mm; *paratype*; UMO 387); Elt. St. 709 (1: 152 mm; *paratype*, poor condition; LACM 10597); Elt. St. 731 (51 : 126-198 mm; *paratypes*; distributed as follow; 45 to LACM 10606; 2 each to BMNH 1982. 4.14.4-5, MNHN 1982-129, and ZIL 46020); Elt. St. 734 (5: 104-174 mm; *paratypes*; USNM 227937); Elt. St. 1536 (5: 164-189 mm; *paratypes*; LACM 10771).

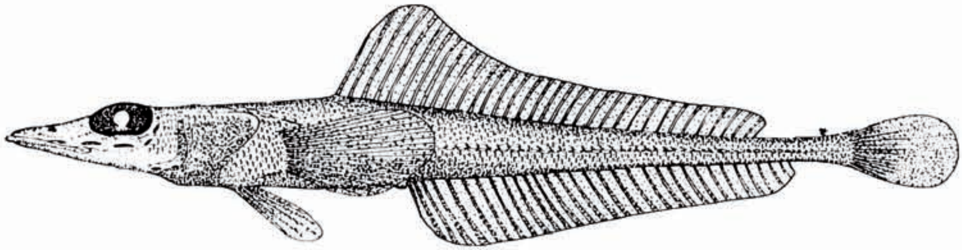

Fig. 1. – *Bathydraco joannae*, lateral view of Holotype, LACM 10606.

Diagnosis.

Head small (280-317 of SL) ; orbits relatively small (214-264 of HL) ; upper jaw relatively short (313-357 of HL) ; distances between tip of snout and origins of dorsal and anal fins short (355-407 and 451-505 of SL, respectively) ; distance between anal fin origin and caudal fin base large (507-553 of SL) ; distance between anal fin origin and base of pelvic fin spine relatively short (194-251 of SL) ; only upper five to seven tenths of opercles scaled ; gill rakers of first arch relatively numerous in various combinations : anterior and posterior series of lower limb (14-17 and 12-16, respectively), total lower limb gill rakers (26-32) and total gill rakers (34-41) ; 55-67 tubular scales in lateral line which extends to base of caudal fin ; vertebrae 16-18 + 34-38 = 51-54.

Descriptive notes.

Nearly all scales ctenoid ; small non-ctenoid scales present only on base of caudal fin. Scales present on all of exposed portion of isthmus, but absent on bases of pectoral rays. Head naked except for upper 5 to 7 tenths of opercles and on cheeks behind ayes. A naked area present on opercle along edge of preopercle and scales absent below eye and on a narrow ventral area behind eye on cheek (skin over lateral line canals naked).

General color of body and head light brown; there are no distinct markings anywhere except for the nostril tubes and the anus, which are dark brown to blackish. Median fins are darker, especially anal and caudal; dorsal darkest anteriorly. Pectoral fins similar to body, pelvics somewhat darker. Belly, opercles and branchiostegal membranes somewhat darker due to dark pigment of pharyngeal lining and peritoneum showing through from inside. Frontals, parietals and supraoccipital somewhat transparent on top of head allowing darker pigment over brain cavity to show as a darker purplish-brown area. Specimens vary in their overall lightness or darkness, but the pattern remains the same.

Name.

This species is named for Joanne DeWitt in recognition of her patience during my absences during trips into the Southern Ocean.

DISTRIBUTION AND RELATIONSHIPS

The species of *Bathydraco* have an entirely Antarctic distribution, being found only from within the region bounded by the Polar Front (Fig. 2). Compared to other notothenioids the species are found in rather deep water. *B. marri, B. joannae* and *B. macrolepis* have the shallowest depth ranges (Fig. 3), but the ranges obscure differences in general habitat. *B. marri* is found almost entirely on the Antarctic continental shelf and nearby islands (*e.g.* South Orkneys). It appears to inhabit deep water because the Antarctic shelf is depressed and in places approaches or slightly exceeds 1000 m. *B. macrolepis*, much less common than *B. marri*, also appears to inhabit mainly the Antarctic continental shelf, but a few specimens have presumably been captured from the upper slope at the north edge of the Ross Sea. *B. macrolepis*, however, apparently does not inhabit the peninsular region as does *B. marri*. *B. joannae* has a depth range similar to that of *B. macrolepis*, but because it is found in a peripheral Antarctic area (Scotia Arc) where shelf depths are less than 200 m, its habitat is entirely on the upper slope. The Remaining species, *B. antarcticus* and *B. scotiae*, are deeper living. The former has a peripheral distribution on deeper ridges and slopes away from the continent. *B. scotiae* has the deepest distribution and is found on the Antarctic continental slope as well as on the Scotia Ridge.

There appear to be two natural groups within the genus. One consists of the species *B. marri, B. joannae, B. macrolepis* and *B. antarcticus*, while *B. scotiae* constitutes the other. The species in the first group all have complete lateral lines on the body, generally fewer dorsal rays and vertebrae, fewer gill rakers, and more completely scaled opercles. The difference in lateral lines and gill rakers are the most trenchant.

Within the larger group there are two pairs of species : *B. antarcticus* and *B. macrolepis* with larger heads and anterior body proportions, smaller posterior body proportions, and fewer opercular scales, with *B. marri* and *B. joannae* having the contrary characteristics. The first two are easily distinguished while the latter two

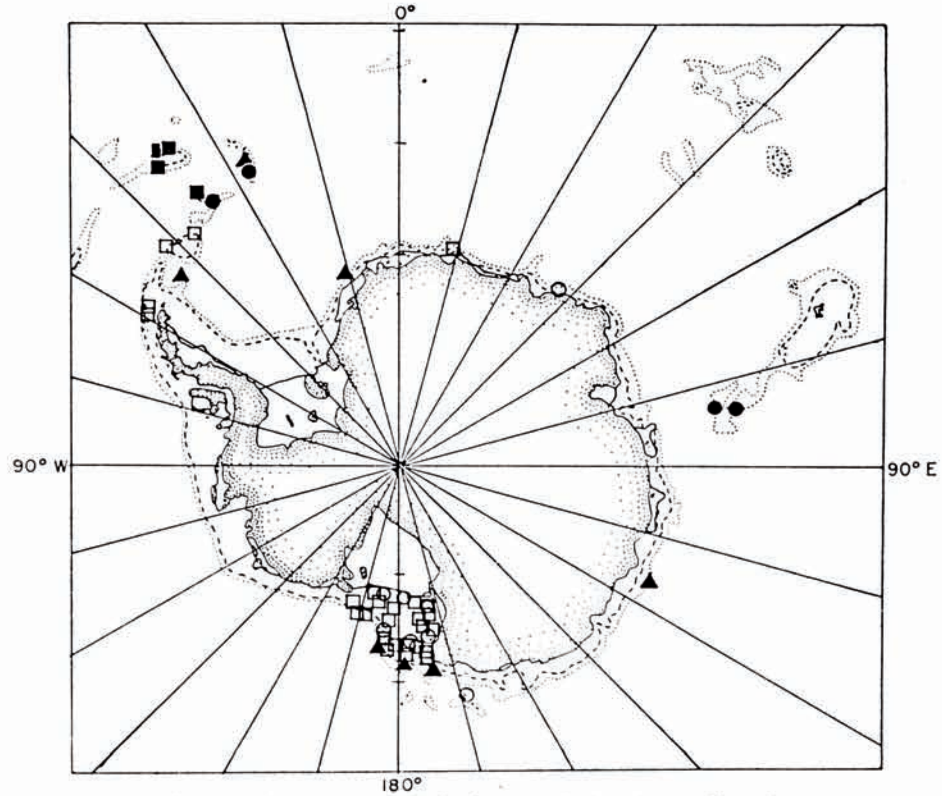

Fig. 2. – Map showing where *Bathydraco* species have been collected.
▲ = *B. scotiae;* ● = *B. antarcticus*; ○ = *B. macrolepis*;
■ = *B. joannae*; □ = *B. marri.*

are more alike and therefore seem more closely related. Distribution corroborates this arrangement, with the members of each pair being allopatric. The only overlapping distributions are those of *B. marri* and *B. macrolepis* in the Ross Sea, but it is probable that the two species occur together throughout much of the continental shelf region from the Ross Sea westward to the Weddell Sea. They have been captured together twice.

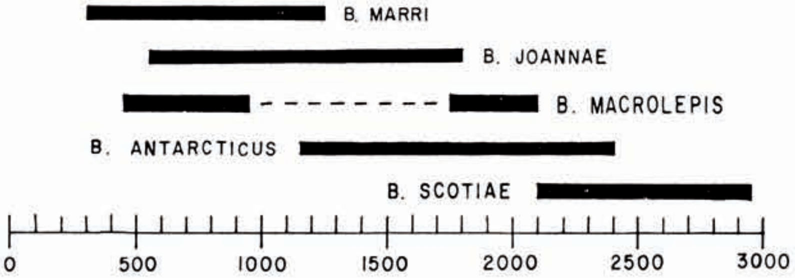

Fig. 3. – Graph showing depth ranges (in meters to the nearest 50 m interval) of *Bathydraco* species.

The lateral lines of *B. scotiae* are incomplete, not extending to below the posterior end of the dorsal fin, and they do not curve ventrally to reach the midside of the body, but remain one scale row above the midside. I was unable to distinguish any naked neuromasts on the side of the body anterior to the caudal peduncle. Other *Bathydraco* species have complete lateral lines which curve ventralward to reach the midside on the posterior part of the body and caudal peduncle. In *B. macrolepis*, however, the lateral lines extend a short distance one scale row above the midside and then drop abruptly onto the midside to continue posteriorly to the base of the caudal fin. There are a few naked neuromasts visible along the midside in a line extending anteriorly to beneath the appressed pectoral fin. *B. macrolepis* and *B. scotiae* may represent two intermediate stages in the development (or loss) of the multiple lateral lines characteristic of Antarctic notothenioids

The family Bovichtidae, with a single lateral line described on each side of the body, has been considered the most primitive family within the notothenioids (Regan, 1913 ; Eakin, 1981). This would indicate that the conditions observed in *B. macrolepis* and *B. scotiae* are derived. The single lateral line of *Cottoperca*, however, appears from figures (Regan, 1913, pls. IV & V) to remain high on the body well onto the caudal peduncle and then to distinctly angle ventralward to end at the midbase of the caudal fin. No additional lines of neuromasts are described in the literature, but existing descriptions are brief and the possibility of an additional line cannot be discounted until specimens can be examined. I cannot, therefore, assume that the single lateral line in *Bathydraco* is primitive or derived. Taking into account the generally derived characters of the Bathydraconidae when compared to the Bovichtidae and Nototheniidae, it seems possible that the single lateral lines of *Bathydraco* species are derived and are correlated with the extreme slenderness of the body and caudal peduncle.

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Table I. – Frequency distribution of head length as a percent of standard length. Each interval includes all values falling within X.0 to X.9.

Percent	28	29	30	31	32	33	34	35	36
B. scotiae			1	2	3				
B. antarcticus						4	3		
B. macrolepis						1	7	2	2
B. marri	11	40	35	8	2				
B. joannae	11	38	13	3					

Table II. – Frequency distribution of orbital diameter as a percent of head length.

Percent	20	21	22	23	24	25	26	27	28	29	30	31	32	33
B. scotiae	2	2	2											
B. antarcticus			3	3	1									
B. macrolepis				6	3	3	1							
B. marri			1	4	10	20	24	12	3	1				1
B. joannae		3	10	16	20	5	1							

Table III. – Frequency distribution of snout length as a percent of head length.

Percent	28	29	30	31	32	33	34	35
B. scotiae					2	1	2	1
B. antarcticus				1	3	2	1	
B. macrolepis		2	3	4		1		
B. marri	3	19	24	24	7	2		
B. joannae		3	11	27	18	1		

Table IV. – Frequency distribution of interorbital width as a percent of head length.

Percent	5	6	7	8	9	10
B. scotiae		1	2	2		1
B. antarcticus	2	1				
B. macrolepis		1	1			
B. marri	12	52	11	1		
B. joannae		19	34	6		

Table V. – Frequency distribution of upper jaw length as a percent of head length.

Percent	31	32	33	34	35	36	37	38
B. scotiae		1		1	2	2		
B. antarcticus				1	1	4		1
B. macrolepis			1	2	7	3		
B. marri		7	24	45	15	1		
B. joannae	9	14	16	8	3			

Table VI. – Frequency distribution of distance between tip of snout and origin of dorsal fin as percent of standard length. Intervals as in Table I.

Percent	35	36	37	38	39	40	41	42	43	44	45
B. scotiae		1	1	3	1						
B. antarcticus							2	2	3		
B. macrolepis								3	6	2	2
B. marri	1	2	19	27	18	10					
B. joannae	1	7	17	26	7	1					

Table VII. – Frequency distribution of distance between tip of snout and origin of anal fin as percent of standard length. Intervals as in Table I ; an asterisk (*) indicates specimen with 3 crushed vertebrae (see text).

Percent	45	46	47	48	49	50	51	52	53	54	55
B. scotiae				1	3	2					
B. antarcticus					1*		1	1	4		
B. macrolepis							1	6	4	1	1
B. marri	1	21	35	31	9						
B. joannae	4	18	21	15	5	2					

Table VIII. – Frequency distribution of distance between anal origin and midbase of caudal as a percent of standard length.

Percent	44	45	46	47	48	49	50	51	52	53	54	55
B. scotiae							4	2				
B. antarcticus			1	3	2		1*					
B. macrolepis	1	1	5	4	2							
B. marri							2	24	49	13	5	
B. joannae							1	6	19	19	19	1

Table IX. – Frequency distribution of anal to pelvic distance as a percent of standard length.

Percent	19	20	21	22	23	24	25	26	27
B. scotiae				6					
B. antarcticus			1*			2	4		
B. macrolepis				1	4	4	3		1
B. marri	1	3	13	33	34	10	1		
B. joannae	3	9	30	16	4		1		

Table X. – Frequency distribution of opercular scalation expressed as tenths of area covered measured from above downward.

Tenths covered	.2	.3	.4	.5	.6	.7	.8	.9
B. scotiae	5	1						
B. antarcticus				7				
B. macrolepis		8	5					
B. marri						5	53	13
B. joannae				18	30	11		

Table XI. – Frequency distribution of numbers of gill rakers in the anterior series of the first arch. UAGR = upper anterior gill rakers; LAGR = lower anterior gill rakers; TAGR = total anterior gill rakers.

	UAGR							LAGR														TAGR																		
Numbers	3	4	5	6	7	8	9	11	12	13	14	15	16	17	18	19	20	21	22	23	24	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
B. *scotiae*					1		4										2		2		1													1		1		2		1
B. *antarcticus*		1		4	2							1	5			1											1	1	3	1			1							
B. *macrolepis*			4	5	3	1			1	5	6	1													3	3	4	2	1											
B. *marri*	4	20	45	21	4	1		4	31	44	12	4										2	11	30	22	23	3	3	1											
B. *joannae*		10	35	18	1					1	6	29	22	6											1	9	22	20	9	3										

Table XII. – Frequency distribution of numbers of gill rakers in the posterior series of the first arch. UPGR = upper posterior gill rakers; LPGR = lower posterior gill rakers; TPGR = total posterior gill rakers.

	UPGR					LPGR											TPGR													
Numbers	1	2	3	4	5	8	9	10	11	12	13	14	15	16	17	18	10	11	12	13	14	15	16	17	18	19	20	21	22	23
B. *scotiae*			2	2	1									1	2	2											2	2		1
B. *antarcticus*			3	4							4	2	1										1	4	2					
B. *macrolepis*	1	3	5						3	5	1								1		5	2	1							
B. *marri*	1	29	52	6		1	3	17	44	19	3	1					1		10	25	34	14		4						
B. *joannae*	2	6	43	12						8	34	17	3	1								11	27	21	2	2				

Table XIII. – Frequency distribution of numbers of combined anterior and posterior lower gill rakers of the first arch.

Numbers	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
B. scotiae																		1	2		1	1
B. antarcticus									1	3	2				1							
B. macrolepis				1	1	3	2	2														
B. marri	1	3	10	20	29	15	6	2	1													
B. joannae							2	9	19	17	9	6	1									

Table XIV. – Frequency distributions of numbers of rays in the dorsal (D), anal (A), and caudal (C) fins.

Numbers	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
B. scotiae	2		3	1		2	1	1	2																						
B. antarcticus																						1		1		1	2	1	1		
B. macrolepis															1		5	4	5	2	2	1	4								
B. marri															1	1	11	19	24	30	12	11	3	6	2						
B. joannae																			2		3	4	7	9	10	11	12	8	1	3	2

Table XV. – Frequency distributions of numbers of left and right pectoral fin rays (P), left branchiostegal rays (L Br), right branchiostegal rays (R Br), and scale rows between the lateral line and the dorsal fin origin (LL - D Sc). An asterisk (*) indicates a damaged fin.

	P					L Br			R Br			LL - D Sc						
Numbers	20	21	22	23	24	6	7	8	6	7	8	5	6	7	8	9	10	11
B. scotiae			5	7			5	1		5	1	1	2	1		1	1	
B. antarcticus		1	2	3			7			7							1	5
B. macrolepis		1	1	2			11	2		9	3	2	5	5	1			
B. marri		16	84	50			87	7	1	82	9			13	37	29	8	1
B. joannae	1*	50	58	8	1		42	23		43	22			1	10	30	7	3

Table XVI. – Frequency distribution of numbers of scales in the lateral line (left and right counts included when both were made).

	D									A							C			
Numbers	32	33	34	35	36	37	38	39	40	28	29	30	31	32	33	34	11	12	13	14
B. scotiae							3	2	1				3	1	2			4	1	
B. antarcticus					2	3	2						4	2	1		1	1		
B. macrolepis	2	3	3	5						1	3	9							2	
B. marri		1	2	10	43	28	8					14	41	32	5			58	9	1
B. joannae		1		15	20	21	8					3	15	28	16	2		55	1	2

Table XVII. – Frequency distributions of numbers of abdominal vertebrae (AV), caudal vertebrae (CV), and total vertebrae (TV), including urostylar element.

	AV				CV							TV								
Numbers	16	17	18	19	32	33	34	35	36	37	38	48	49	50	51	52	53	54	55	56
B. scotiae		3	4	1					4	3	1						2	2	3	1
B. antarcticus		3	3				1	2	3							1	5			
B. macrolepis	6	6			5	6	1					2	7	2	1					
B. marri	9	79	3			3	25	51	8					2	25	43	5			
B. joannae	21	41	1				4	24	27	7	1			6	34	20	3			